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Notice of some Errors in Baily's Tables and Formulæ. By J. O. Farrell, Esq.

The late Mr. F. Baily's *Astronomical Tables and Formulæ* (London, 1827) being a work of considerable reputation and of frequent reference by the practical and theoretical astronomers of this country; perhaps it may be useful to point out an error in one of the formulæ, as it has led the author to insert, in the *Elements of the Solar System*, an erroneous value of the excentricity of the earth's orbit. I refer to formulæ xlvi. (p. 119), the first two of which give the relations between the excentricity (e) and the greatest equation of the centre (E), viz.—

$$E = 2e + \frac{11}{2^4.3} e^3 + \frac{599}{2^{10}.5} + \frac{17219}{2^{16}.7} + \ldots.$$

$$e = \tfrac{1}{2} E - \frac{11}{2^4.3} E^3 - \frac{587}{2^{16}.3.5} - \frac{40583}{2^{23}.5.7.9} - \ldots.$$

The first equation is correct; but in the second equation the coefficient of E^3 should be $-\frac{11}{2^8.3}$, instead of $-\frac{11}{2^4.3}$. As the author appears to have followed Delambre very closely (see note, p. 229; also p. 274, line 2), it is very likely that these formulæ have been copied from Delambre's *Abrégé d'Astronomie*, p. 256, where the very same error occurs.

In pages 19 and 66 the excentricity of the earth's orbit (1 Jan. 1801) is stated to be ·016783568. The author, having remarked that it differs from that given by Laplace (·01685318), informs us that he has deduced this value from the greatest equation of the centre (1° 55′ 27″·3), by means of the formula $\frac{1}{2} E - \frac{11}{48} E^3$. The correct formula, however, as above stated, is $\frac{1}{2} E - \frac{11}{768} E^3$; and hence the excentricity corresponding to the greatest equation of the centre here assumed is 0·016791707. That this is the proper value is confirmed by Bessel's value for the same epoch (·0167918226), given in the Appendix, p. 270. With respect to Laplace's value of this quantity (·01685318), it would seem to be that corresponding to a previous epoch; but not having hitherto had the advantage of consulting any of Laplace's works, I am unable to verify the conjecture.

Again, assuming the values of greatest equation of the centre given in p. 66, I have calculated the corresponding values of the excentricities; they are inserted in the last column of the following table; from which it appears that values of these quantities, given by Mr. Baily, for *Mercury*, *Venus*, *Earth*, and *Mars*, are very inconsistent.

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Planet.	Greatest Equation of Centre. Baily, p. 66.	Excentricity. Baily, p. 66.	True Excentricity corresponding to Greatest Equation.
	° ′ ″		
Mercury	23 39 51·0	·205514940	·20549252
Venus	0 47 15·0	·006860740	·00687220
Earth	1 55 27·3	·016783568	·016791707
Mars	10 40 50·0	·093307000	·09311252
Jupiter	5 31 13·8	·048162100	·04816264
Saturn	6 26 12·0	·056150500	·05615019
Uranus	5 20 57·0	·046679380	·04666863

The elements of the orbits of *Jupiter* and *Saturn* are very nearly consistent. The error in that of the *Earth* has been accounted for above; but in those of *Mercury*, *Venus*, and *Mars*, the inconsistency is so great that it is difficult to account for it without reference to the original works from which they may have been extracted or deduced.

As, however, these wrong or inconsistent excentricities have been inserted by Sir John Herschel in all the editions of his treatise on Astronomy (*Lardner's Cyclopedia*, new edition, 1842; *Outlines of Astronomy*, 3d edition, 1850), and thence into almost all our popular works on Astronomy, it seems very desirable that an authoritative synopsis of the elements of our system should be prepared, and thus prevent, if possible, the perpetuation of the erroneous elements referred to.

It may be worth while to notice, briefly, another error in the formulæ which also appears to have led the author and others into error.

In formulæ xliii. p. 116, for computing the relative length of a degree of longitude and latitude, &c. on the surface of the earth, the expression for the length of a degree of latitude is wrong; it should be multiplied by the length of a degree of latitude at the equator. This mistake makes all the numbers in the column "Degree of latitude" (Table xxxiv. p. 181) erroneous. This wrong formula also causes a similar error to exist in Table viii. appended to F. W. Simms's treatise on Mathematical Instruments (London, 1844), where the lengths in feet of a second of latitude are erroneous.

A somewhat similar error occurring in the last edition of Biot's *Traité Elémentaire d'Astronomie Physique* (Paris, 1857) may be noticed. I refer to the Table of the Elements of the Orbits of the Asteroids, given in tom. v. pp. 531, 532, of the above work, where the numbers inserted in the column "Moyen mouvements" are altogether erroneous.

Ordnance Survey Office, Southampton,
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